

Annual Status Report

2002

**Black-tailed Prairie Dog Monitoring at
Scotts Bluff National Monument**

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1.0 INTRODUCTION

1.1 Background

Black-tailed prairie dogs (*Cynomys ludovicianus*, BTPD) historically occupied over 100 million acres of shortgrass and mixed-grass prairie in 11 western states (National Wildlife Federation 2000a). Currently less than one percent of this habitat remains occupied, 700,000 to 800,000 acres. The dramatic decline in BTPD habitat and abundance is the result of changing land use patterns, habitat fragmentation, disease, shooting and poisoning (U.S. Fish and Wildlife Service 2000). Sylvatic plague (*Yersinia pestis*), introduced from Europe and first identified in prairie dog populations in the mid-1930's (Hubbard 1947) is capable of causing massive die-offs in prairie dog populations (Barnes 1993, Cully 1993). Wide spread control of prairie dogs through shooting and poisoning is still practiced in most states. Most states require the eradication of the species on private and publicly held lands at the expense of the landowner (Desmond et al. 2000). However, this requirement for eradication of BTPD has been relaxed in many states since 2000, when the Fish and Wildlife Services ruled the species warrants listing as threatened under the Endangered Species Act of 1973 (US Fish and Wildlife Service 2000). Species dependent on the BTPD for food or the habitat they produce include the Burrowing owl (*Athene cunicularia*), Mountain plover (*Charadrius montana*), Kit fox (*Vulpes velox*), and Ferruginous hawk (*Buteo regalis*) (National Wildlife Federation 2000b). These species are candidates or potential candidates for listing as threatened species under the Endangered Species Act. America's most endangered mammal; the Black-footed ferret (*Mustela nigripes*) is wholly dependent on the prairie dog for its survival (National Wildlife Federation 2000b).

Concerns for recovering the BTPD to stable numbers on National Park Service (NPS) lands has prompted the Park Service to identify parks and monuments within the historic range of the BTPD that still host populations of prairie dogs. Seven of the 29 parks or monuments within the historic range of the BTPD still maintain populations (Badland's National Park, SD; Bent's Old Fort National Historic Site, CO; Devil's Tower National Monument, WY; Fort Larned National Historic Site, KS; Scotts Bluff National Monument, NE; Theodore Roosevelt National Park, ND; and Wind Cave National Park, SD).

The colony of BTPD at Scotts Bluff National Monument, Nebraska (SCBL) was reestablished in 1981 from vagrant individuals moving onto the monument. Black-tailed prairie dogs had been exterminated from the monument in 1944. Colony size, population densities, and estimates of overall abundance of BTPD at SCBL from 1981 through 1994 are given in Table 1. The rapid and sustained decline in BTPD numbers between 1988 and 1995 could be the result of several factors including illegal shooting or poisoning, poor winter survival, predation, or Sylvatic plague (Knowles 1998).

For the period 1995 - 1999, BTPD were monitored through a joint effort of the Prairie Cluster Prototype Long-Term Ecological Monitoring Program (PC-LTEM) and the Biological Resources Division (BRD) of the U.S. Geological Survey. A peer-reviewed monitoring protocol is the result of this endeavor (Plumb et al. 2001). Park personnel and PC-LTEM staff continue annual BTPD monitoring. This report describes monitoring results for 2002.

1.2 Objectives

The objectives of BTPD monitoring at SCBL are to: 1) estimate BTPD population abundance; 2) map annual size and location of the BTPD colonies; and 3) determine through observation if Sylvatic plague (*Yersinia pestis*) is present in BTPD colonies.

2.0 METHODS

2.1 Black-tailed Prairie Dog Density and Abundance

Plumb et al. (2001) detail the current monitoring methods used to estimate BTPD densities, abundance and colony sizes. The BTPD colony at SCBL was observed from two viewing stands in 2002. Eight replicate counts, with 15-minute intervals between the start of each replicate, were made from each stand on three days, July 18, 19 and 21. As a result of recent colony expansion, two observation stands were necessary in 2002 to characterize the entire population. Using landscape features, a section of the colony was defined for observation from each of the stands in an effort to minimize counting individuals twice during a replicate. Therefore, daily replicate counts from each stand were combined in order to calculate estimates of population density and size. Prairie dogs on the east and part of the southern sections of the colony were counted from a stand located on the eastern edge of the colony (Figure 1). Prairie dogs on the north, west and extreme southern section of the colony were counted from a stand located in the middle of the colony. Surveys were conducted between 6:45 – 8:45 am on mornings with little or no precipitation, temperatures > 10 °C (50 °F) and wind speeds < 32 kph (20 mph). Timing of replicate counts from each stand was synchronized so counts could be combined.

Using the combined visual count data, two calculations were made to estimate annual BTPD density and abundance within the colony at SCBL.

Density (P) = $([Y / Sp] - [3.04 / 0.40])$, where Y is the maximum count of individuals in a replicate over the three day survey period and Sp the total area sampled. Density is calculated from the maximum count of individuals in a replicate and colony size, adjusted for the probability of not observing all individuals during the count. The adjustment coefficient is based on mark-recapture data (Severson and Plumb 1998).

Abundance (T) = (Sc)(P), where Sc is the total colony size in hectares and P the estimated density per hectare.

A 95 % confidence interval was calculated for density and abundance using the following formulas:

$$\begin{aligned} \text{Density lower limit, } P &= P - 1.96 [SE(P)] \\ \text{Density upper limit, } P &= P + 1.96 [SE(P)] \\ \text{Abundance lower limit, } T &= T - 1.96 [SE(T)] \\ \text{Abundance upper limit, } T &= T + 1.96 [SE(T)] \end{aligned}$$

where SE is the standard error for Density (P) and Abundance (T), respectively. Standard error (SE) is derived by first calculating Variance (P) = $66 + 0.025 (P - 18.4)^2$ for Density (P) or Variance (T) = $66 + 0.025 (T - 18.4)^2$ for Abundance (T) and then calculating SE (P or T) = $\sqrt{\text{Variance (P or T)}}$. Means with widely overlapping confidence intervals are not significantly different.

2.2 Black-tailed Prairie Dog Colony Mapping

Boundaries of active burrows and active clip line on the BTPD colony at SCBL were delineated using a Global Positioning System in conjunction with a PC-based Geographic Exploration Systems, ArcViewTM. Burrows were classified as active if burrow openings were > 7-cm in diameter, the burrow was within 5-m of an active clip line, and fresh scat was observed within 0.5-m of the opening. Burrows were not classified as active if there were spider webs across an opening or unclipped vegetation growing in or around the opening (Biggins et al. 1993, Desmond et al. 2000). Colored pin flags were used to mark the active burrows on the perimeter of the colony and delineate the perimeter of the active clip line prior to GPS mapping. In most cases the active clip line was not easily distinguishable due to drought. Therefore, the extent of active burrows closest to clipped vegetation was marked. Boundaries were walked in their entirety regardless of which mapping technique was employed in order to close the colony polygons.

In 2002, colony size was mapped by combining the greatest extent of both active burrows and active clip line while in the field. The two parameters were combined in order to map the largest extent of active colony perimeter and alleviate problems with identifying clip lines in many places do to the effects of a drought on live vegetation. As a rule, the mapping of both parameters independently produces varying yet statistically similar estimates of colony size (Plumb et al. 2001). Therefore, combining both active burrows and active clip line within a year while mapping gave a more robust measure of colony size.

2.3 Sylvatic Plague Surveillance

Park personnel monitor Sylvatic plague presence within the BTPD colony at SCBL throughout the year. Observation of a substantial die-off in the population during the year alerts park personnel to the potential of a Sylvatic plague outbreak. If a Sylvatic plague outbreak is suspected, appropriate authorities will be notified to verify the presence or absence of Sylvatic plague.

3.0 RESULTS

3.1 Black-tailed Prairie Dog Abundance and Density

The results of BTPD monitoring in 2002 are given in Table 2 and Figures 2 and 3, along with the previous seven years. Population size in 2002 was estimated at 381 individuals, demonstrating an increase of 126 individuals (49%) over 2001 levels (Figure 2). The BTPD population estimate was 230.9 individuals higher than the eight year average (1995-2002) of 150.1 individuals / year. This year's population was the largest-recorded under the current monitoring protocol (in use since 1995). The density of BTPD was 19 individuals / ha in 2002, representing a decrease of 4.4 individuals / ha (18.8%) from 2001 (Figure 3). Density averaged 4.1 individuals / ha lower than the eight-year average (1995-2002) of 23.1 individuals / ha.

3.2 Black-tailed Prairie Dog Colony Mapping

Maps showing changes in the location and extent of the BTPD colony at SCBL between 1995 and 2002 are shown in Figures 1. The colony area was 20 ha in 2002,

representing an increase in size of 9.1 ha (84%) from 2001 (Table 2). The relative shape and location of the main colony was unchanged. Colony size was 11.7 ha larger than the eight year average of 8.3 ha.

Two new active BTPD colonies were recorded in 2002. One located north of the irrigation canal near the original colony had an area of 0.096ha. The other colony, located in the Saddle Rock Unit had an area of 0.865 ha.

3.3 Sylvatic Plague Surveillance

Sylvatic plague was not observed in the BTPD colonies at SCBL during 2002.

3.4 Other observations

Coincidental counts of Burrowing owls revealed seven to nine individuals on the colony, up from one in 2001. Sightings of Burrowing owls will continue to be recorded and included in annual reports.

4.0 DISCUSSION

In the past, a single observation tower was adequate to exhaustively sample the population. However in 2001, colony expansion dictated the need for a second tower to view the entire population (Figure 1). Plumb et al. (2001) recommended conducting visual counts on a single 200 x 200-m section of a colony. However, the unique crescent shape of the BTPD colony at SCBL and variations in population densities across the colony dictated dividing the colony into two sections for visual counts and subsequently sampling the entire colony. In the future, two stands will continue to be used for observing the colony unless its size, topography and vegetative cover become such that one observation tower is sufficient.

It appears that a rapid outward expansion of the BTPD colony occurred again in 2002, resulting in the largest area recorded under the new monitoring program. The area has expanded greatly compared to 2001; a year in which the colony's size had declined (Figure 1). Poor vegetative growth due to poor soil conditions may have caused colony expansion because prairie dogs had to range further to forage. However, it is very probable that less favorable climatic conditions (lower precipitation) in 2002 over 2001 (Figure 4) resulted in less nutritious vegetation within the colony, thus further ranging by BTPD. Regardless of the cause, the lack of green nutritious vegetation in the colonized area appears to have caused colony expansion and encouraged colonization of new areas. BTPD numbers were greater in 2002 than 2001 but density was less, due in part to the 84% increase in area occupied by the colony.

The decline in the population density of BTPD at SCBL seems to mirror those reported since 1996 and prior to 2001, a year when density increased. The population density averaged 4.4 individuals / ha below the 2001 estimate (Figure 3), but equal to the four year average for 1997-2000. Population size was the highest recorded under the current monitoring effort (Figure 2). This increase in population size was accompanied by an equally impressive increase in area occupied by the colony, explaining a substantial decrease in estimated density of BTPD. The dry soil and little nutritious vegetation probably forced the prairie dogs to occupy a colony of larger size. However, the BTPD density estimate was not significantly different between this year and any other year since 1995 based on overlapping confidence intervals (Figure 3).

Presently, colonies occupy only a small portion of the monument (i.e. 3% of the monument's 698-ha of grassland). Physical barriers once thought to curtail BTPD colony expansion and limit colony size were breached in 2002. Ridges created when wind blown sediment was deposited along fence lines bound the south side and a portion of the eastside of the colony, and the fenced boundary and adjacent private cropland on the west continue to limit expansion in those directions. However, the large irrigation canal and road bounding the colony to the north were most likely crossed and a small colony (0.096 ha) of only a few individuals has established. In 2002, the colony expansion to the east continued, and a north-south oriented ditch may have been crossed as a colony has also established on the eastside of the park (prairie restoration site, Saddle Rock Unit).

Because colony expansion is limited, dispersal from the colony and the establishment of new colonies was anticipated (BTPD annual Report 2001). While it is likely that the colony north of the irrigation canal came from the original colony, the colony in the Saddle Rock Unit may have established from individuals migrating into the monument. BTPD crossing the north-south ditch on the eastside of the main colony would have to of negotiated several steep valleys and the bluff that lay between the original and new colony in order to establish the new colony. The two new colonies will be visited again in 2003 to determine if any future monitoring should be initiated. Monument staff should continue to monitor for new occurrences of BTPD colonies in other areas of the monument. Dispersal usually begins in late winter and is complete by the end of June (Garrett and Franklin 1988, Hoogland 1995).

Black-tailed prairie dog monitoring at SCBL will continue as part of the NPS's effort to address concerns over population status on their lands. Annual monitoring of the colony at SCBL allows resource managers the opportunity to assess the impacts of colony expansions on the cultural and natural resources of the monument, and assess the status of BTPD at SCBL in comparison to other NPS lands. Sylvatic plague surveillance as well as surveillance for other mortality factors will continue to be a routine part of the assessment of the BTPD colony at SCBL. Surveillance of mortality factors must be undertaken if a rapid decline in the BTPD population is observed to minimize the risk to human health without causing undo concerns. Findings from monitoring efforts on BTPD at SCBL should be incorporated with those from other NPS lands in order to help recover this element of the prairie ecosystem to sustainable numbers. If BTPD were listed as federally threatened, recovering their numbers on NPS lands will become even more important.

5.0 PLANS FOR 2003

Black-tailed prairie dog density, abundance and colony sizes at SCBL will continue to be monitored with methodologies outlined by Plumb et al. (2001). The BTPD colony will be observed from two viewing stands again if its size and shape dictates doing that. Both newly established colonies will be monitored if it is determined they are of a size that warrants doing so and their establishments are being maintained or growing.

6.0 REFERENCES

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Table 1. Colony size, population density and number of individual Black-tailed Prairie Dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska between population reestablishment and 1994. Sources of annual data are indicated.

Year	Area (ha)	Density (individuals/ha)	Population Size	Source
1981	Colony Reestablishment in Scott's Bluff National Monument			
1982	--	--	--	None
1983	0.98	76.5	75	Franklin 1984
1984	1.31	30.5	40	Franklin 1984
1985	--	--	107	Cox and Franklin 1989
1986	5.77	34.7	200	Cox and Franklin 1989
1987	5.14	58.9	303	Cox and Franklin 1989
1988	3.39	64.6	219	Cox and Franklin 1989
1989	--	--	62	Monument Personnel unpub.
1990	--	--	62	Monument Personnel unpub.
1991	--	--	27	Monument Personnel unpub.
1992	--	--	--	None
1993	--	--	45	Monument Personnel unpub.
1994	--	--	--	None

Table 2. Colony size (95% CI), population density (95% CI) and number of individual Black-tailed Prairie Dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska between 1995 and 2002.

Year	Area (ha)	Density (individuals/ha)	Population Size
1995	1.4	12 (-4.1-28.1)	17 (1.1-32.9)
1996	1.4	21 (5.1-36.9)	29 (12.7-45.2)
1997	2.6	28.9 (12.7-45.2)	75 (51.3-98.7)
1998	3.3	22.7 (6.7-38.7)	75 (51.3-98.7)
1999	10.5	16.7 (0.8-32.6)	175 (123.9-226.1)
2000	16.2	9.2 (0.9-17.5)	149 (105.5-192.5)
2001	10.9	23.4 (7.4-39.4)	255 (179.7-329.6)
2002	20.0	19.0 (3.08-34.92)	381 (62.51-699.49)

Figure 1. Black-tailed prairie dog (*Cynomys ludovicianus*) colony sizes and shapes at Scotts Bluff National Monument, Nebraska for years 1995 to 2002, exception 1996. The colony size and shape was roughly the same for 1995 and 1996. The colony boundary for 1995 is shown on all years as a reference.

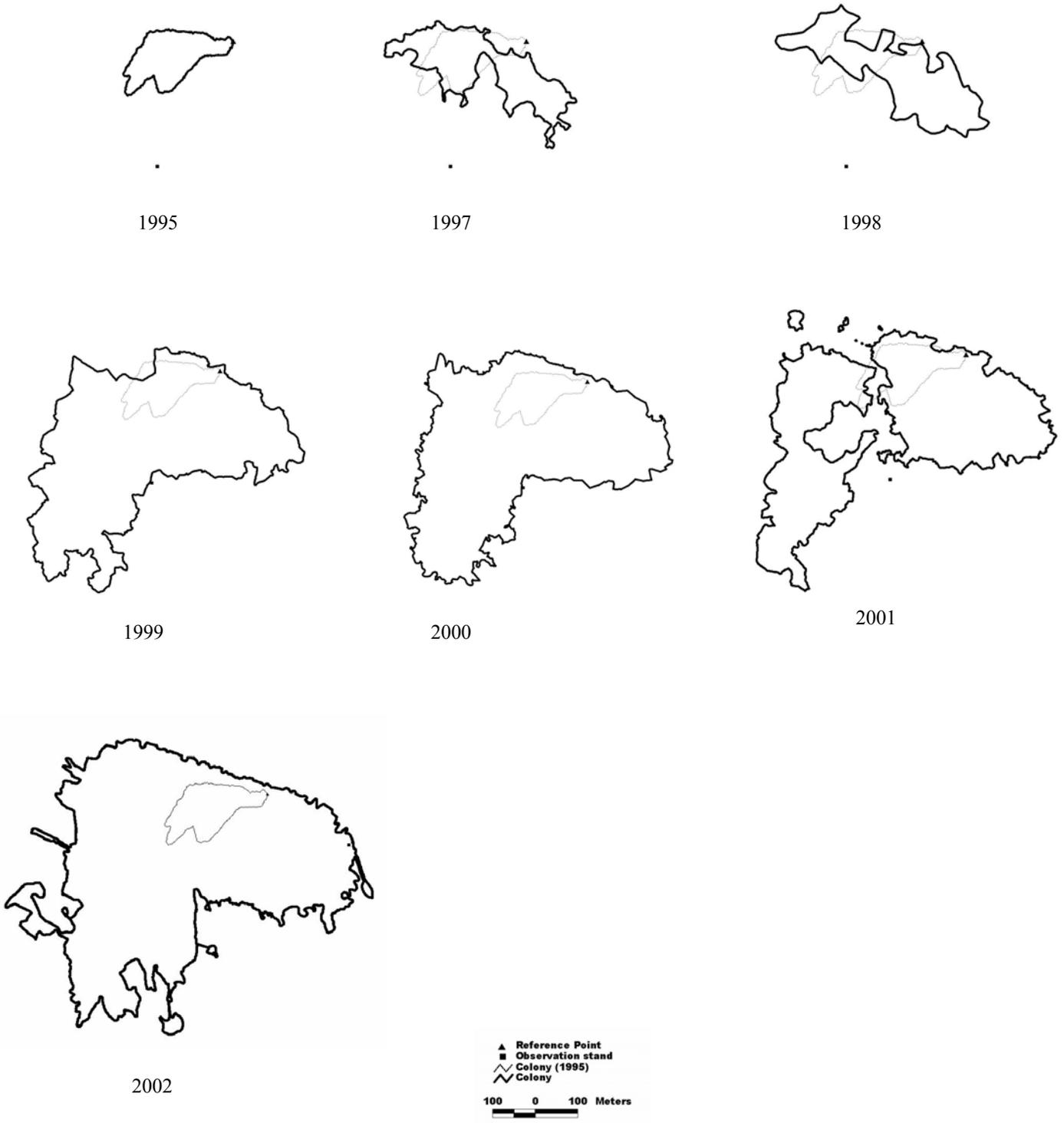


Figure 2. Estimated Black-tailed prairie dog population estimates (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska for years 1995 to 2002. Bars at each annual population estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their population estimate are not significantly different.

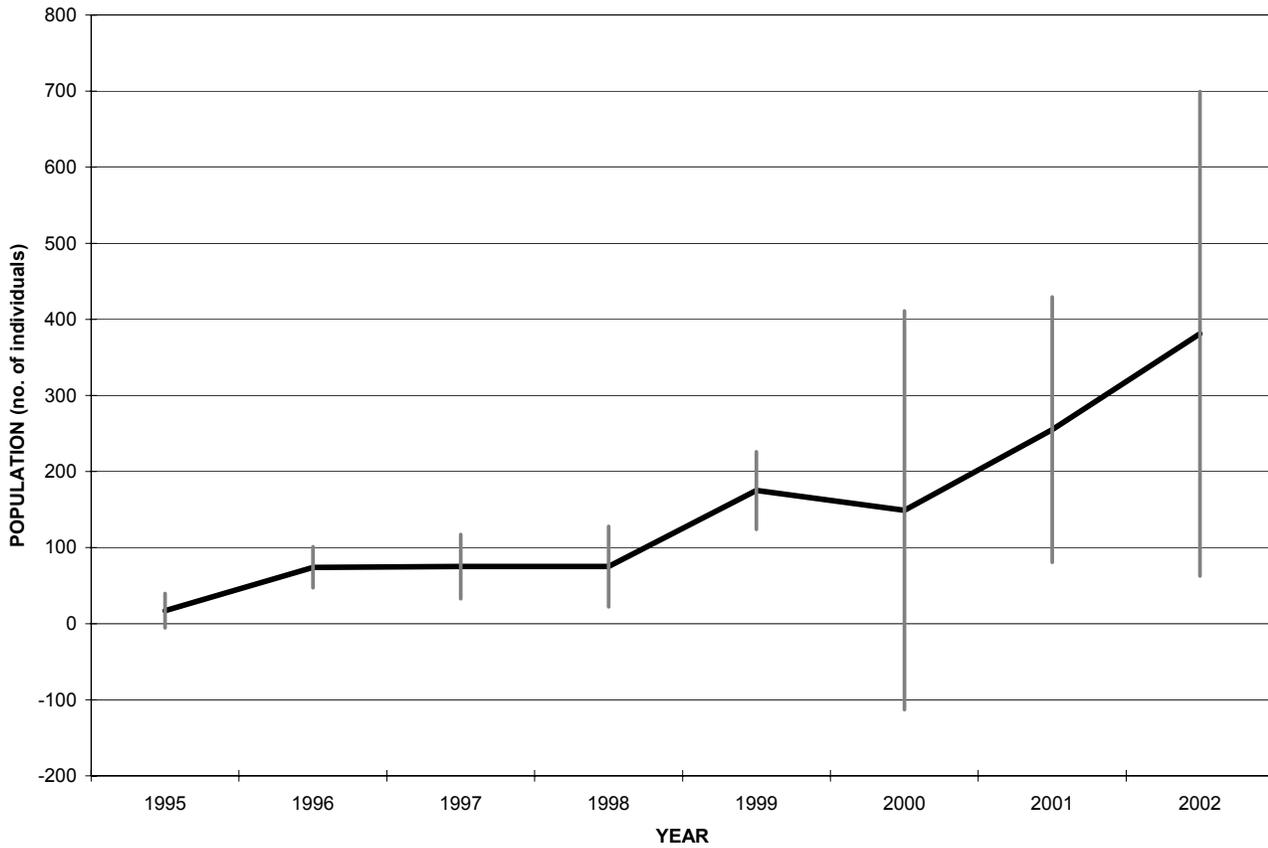


Figure 3. Estimated Black-tailed prairie dog densities (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska for years 1995 to 2002. Bars at each annual density estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their density estimate are not significantly different.

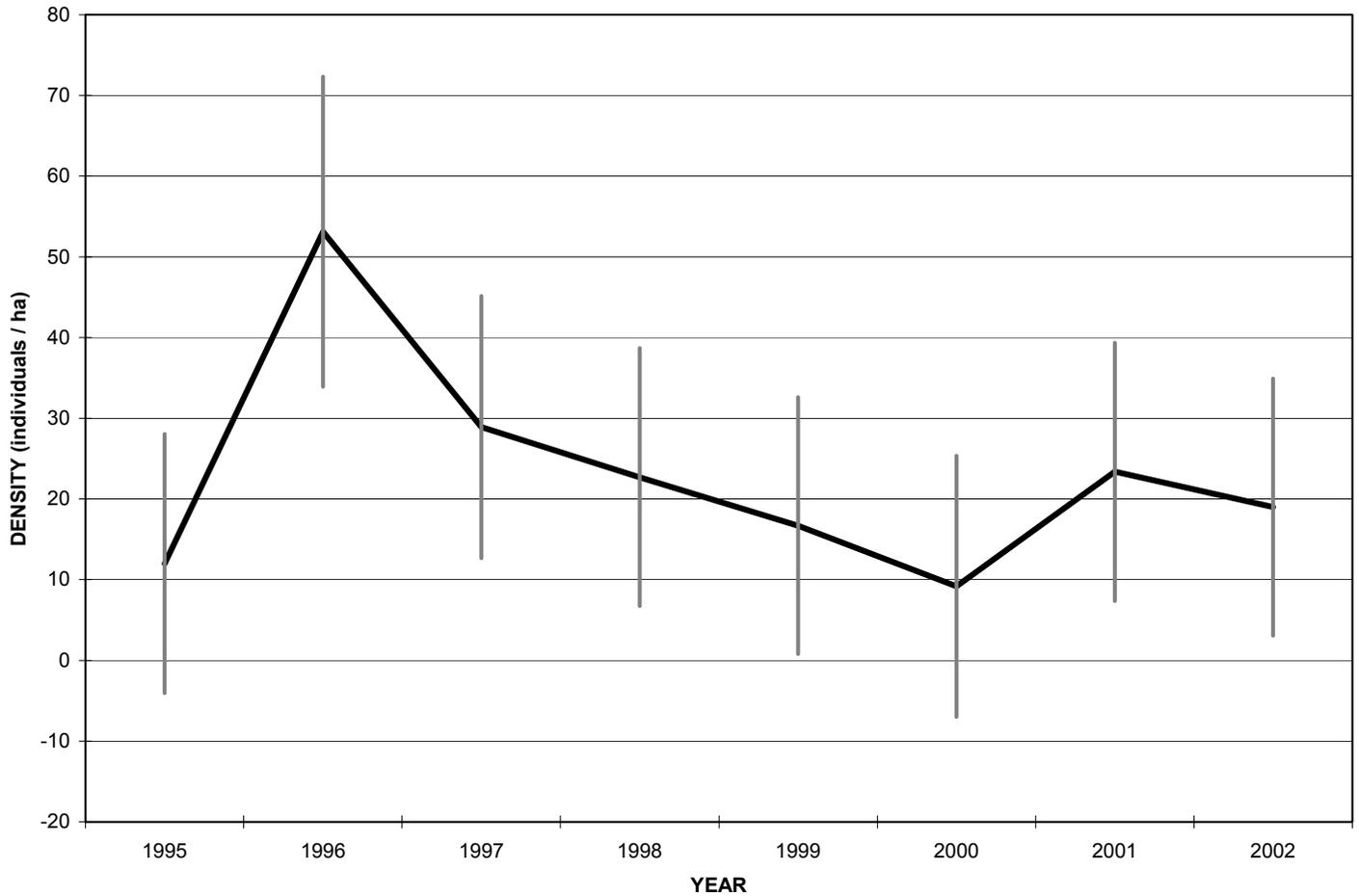


Figure 4. Cumulative precipitation for the first seven months of each year shown annually as deviations from the seven year average (1996-2002) at Scotts Bluff National Monument, Nebraska. Precipitation averaged 25.73 cm for the first seven months of a seven-year period.

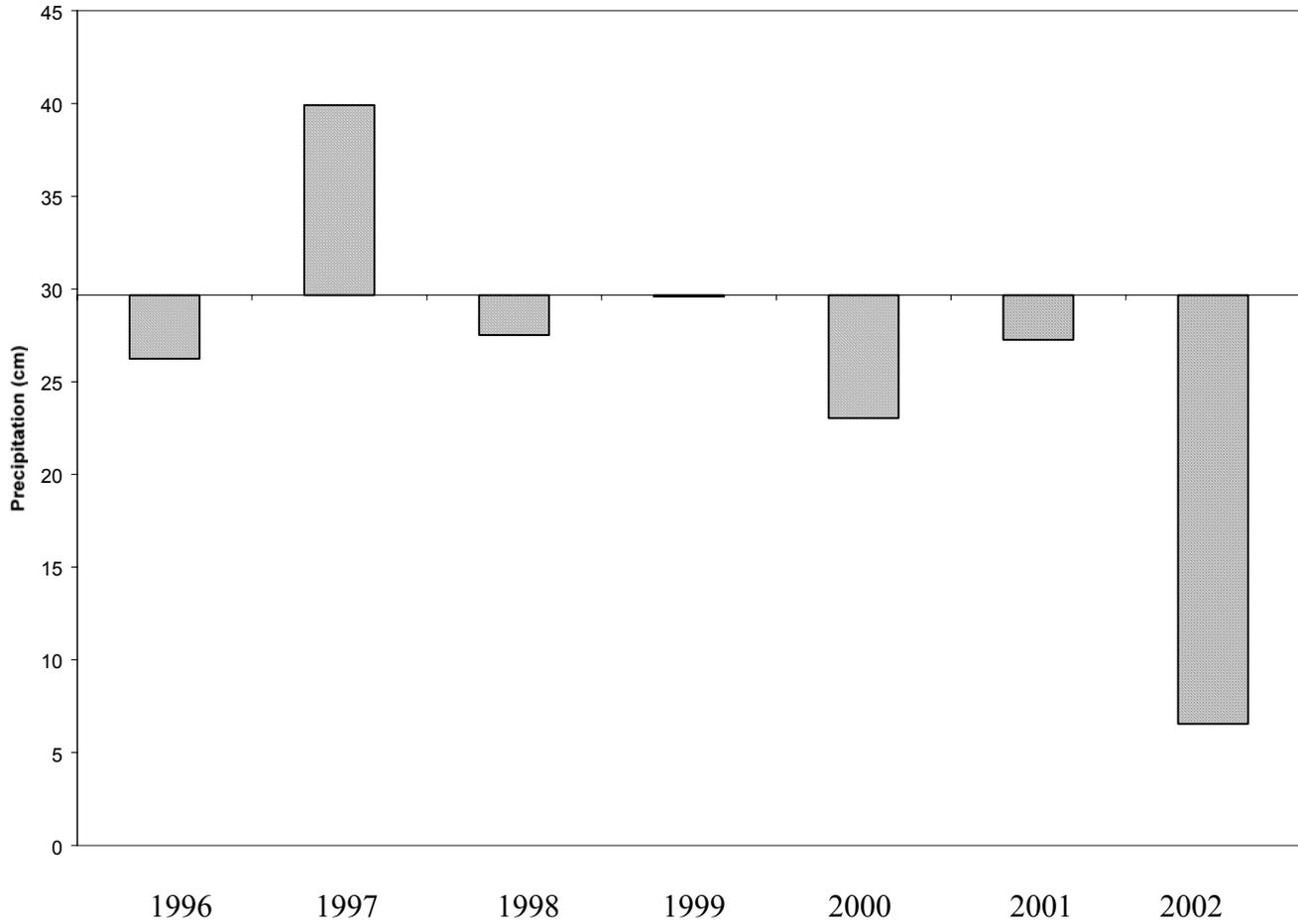


Figure 5. Mean temperature May-August for a eight year period at Scotts Bluff National Monument, Nebraska.

